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CORRESPONDENCE.

Compilation of Data on Electric-Power Conductors.

Sir: It was a pleasure for me to read your carefully considered review of my book entitled "Electric Power Conductors" which appeared in the current issue of the Engineering News. The review shows evidence of a critical examination of the book (which is rather rare in these days of cheap technical journalism) and is well written. There is, however, a point where I think your reviewer has made a mistake and that is where you compare my book with Dr. Perrine's "Conductors for Electrical Distribution," saying among other things that "the general scope of the two books is the same." Your reviewer's recollection of Dr. Perrine's excellent work must be somewhat imperfect, as it is a class-book or text-book treating of the manufacture and properties of electric conductors, whereas mine is a reference book on the engineering considerations concerning the purchase and use of electric-power conductors. Furthermore, the former book is to be read, the latter to be referred to. I think my book is ill-adapted to the purpose that Dr. Perrine's book is best suited to, and I think that Dr. Perrine's book is equally ill-suited *as a reference book* to assist an engineer in purchasing and using electric-power conductors.

The two books are complementary to one another and are not in competition; they are brought out by the same publishers and each covers a different field so that together they aspire to cover the entire field of electrical conductors.

I did not make the acquaintance of Dr. Perrine's book until mine was accepted for publication; that is, after mine was finished. I then took the precaution to go over my manuscript eliminating almost everything which duplicated Dr. Perrine's work. I believe upon careful comparison of the two works you will find the amount of matter in my book which is also in Dr. Perrine's is very small.

Yours very truly,

Wm. A. Del Mar.

335 Madison Ave., New York City, Nov. 23, 1909.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS.—Transactions, Vol. I., 1908. (John C. Olsen, Secy., Polytechnic Institute, Brooklyn, N. Y.) New York: D. Van Nostrand Co. Cloth; 6 × 9¼ ins.; pp. 204; text illustrations, and tables and charts in pocket. $6, net.

This newly organized society, with about a hundred members, has issued its Transactions as a bound volume. The first volume contains the history of the movement for the organization, the constitution and by-laws and an account of the first meeting. This preliminary material, included only in the "Proceedings" of most other societies, is followed by the papers presented at this meeting.

REVIEWS.

A Treatise on Joints.

Reviewed by ROBERT FLETCHER,* M. Am. Soc. C. E.

STRUCTURAL DETAILS.—Or Elements of Design in Heavy Framing. By Henry S. Jacoby, Professor of Bridge Engineering in Cornell University. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5⅝ × 9¼ ins.; pp. 368; six folding plates and numerous text illustrations. $2.25, net. English price, 9s. 6d., net.

This notable and valuable contribution to engineering literature presents the subject matter under six chapter headings: I. Fastenings used in framing, including all forms of nails, bolts, screws, wooden pins, dowels, keys, straps, etc., and their adjuncts. Full data are given concerning holding power and strength under all conditions of use, with suggestions as to design, and the most important and appropriate applications.

II. Joints used in framing. The various forms of tabled fish-plate joints, with wooden and metal plates, are shown and discussed, including the theory of the pressure of wood on metal pins and the bending moment in the bolt or hardwood pin; and also the problem of proper design. The tenon-bar splice described in Engineering News of May 30, 1909, is also illustrated and discussed. Then the different styles of lap and scarf joints and some applications are well exhibited. Various joints in bearing and some principal uses are then completely shown and discussed, including dove-tail joints, mortise-and-tenon, step-joints, angle blocks and metal shoes.

Chapter III. is devoted to wooden beams and columns, including tests and inspection. The beam as a problem in design is duly treated; then the principles of framing and construction of beams and trestles; packed stringers, hangers and anchorages, combination beams, trussed beams and girders, including car frames, and a very satisfactory example of design, including use of graphic statics. The design of wooden columns is well discussed, with nine references to the most important recent articles on the subject. The construction of posts is presented by a wealth of illustrations, and the details of bolsters, post-caps, angle blocks and angle braces receive due attention. Applications are shown by sufficient illustrations, some of which are full-page. Kidwell's tests to determine the comparative merits of iron and wooden bracing for mine timbering are brought to the reader's notice.

Wooden roof-trusses are sufficiently discussed in Chapter IV. This deals with types and weights and stresses in the rafters and purlins. The rafter problem is treated simply and directly, and the purlin is treated as a beam whose resultant load makes an angle with its longer axis, thus involving the moments of inertia about both rectangular axes. The proper order of design is stated in 18 paragraphs, followed by specifications for rafters and purlins. Truss loads and stresses are analyzed, and the design of the joints is then taken up with full details well presented by clearly-drawn figures. Analysis of weight and cost is followed by an article on some interesting and instructive tests of end joints made by Scott-Moncrieff, and describing other tests at Cornell University. A full article on details follows, and one on examples from practice illustrated by inset plates. Thirty-three references to illustrated articles in the technical periodicals conclude this chapter.

Chapter V. presents, by illustration and description, instinctive actual examples of framing among them slow-burning construction, trestles, small bridge trusses, frame for a bridge-pontoon, wooden arches, arch centering for various conditions, timber flumes, traveler frames, falsework frames, railroad station building, and Wakefield sheet-piling. Then follow 91 references to engineering literature.

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Chapter VI. treats briefly of timber tests and unit stresses, with articles on commercial sizes and grades, tests, variation in strength of timber, degree of security, working unit stresses, and building codes. The last article gives the titles and descriptions of 24 reference handbooks.

As a specimen of the bookmaker's art the treatise is unexceptionable in typography, arrangement, and character of the illustrations; the latter are distinctly drawn, well lettered and well printed.

In Chapter II. the author lays proper stress on the preservation of joints, but he might have treated this theme more at length. When we consider that the continued durability and serviceability of the joints may easily double or treble the working life of a structure under some conditions, we cannot overrate the importance of this phase of construction. The reviewer recalls the failure of a timber frame holding the headgate of a mill flume, resulting in the drowning of a wheelwright who was working on the wheel in the pit. This was due firstly to bad design of the joint, secondly to utter neglect of protection. The carelessness of inspectors, contractors, and even of engineers, in this respect is well known. As an instance, the joint-work of an anchorage of a well-known cantilever bridge, built under design and direction of a distinguished engineer with (presumably) a competent force of inspectors, was found after some years to be in condition of dangerous deterioration, due to neglect at the time of erection of most ordinary precaution and means of protection. The average builder, or carpenter, or contractor or workman on the job thinks there is too much bother in having a paint pot around or using it when he is busy on his routine work. Joints soon get out of sight and so "out of mind." There is need of educating the young engineers and all who have responsible oversight of works to realize the vital importance of this matter. The failures of structures—some even reaching the proportions of great disasters—due to defective or neglected joints, are matters of common knowledge among engineers, which, if fully recorded, would make a chapter "brimful of instruction" to the profession. Smeaton is said to have personally attended to the fastening of every bolt and turning of every screw in the construction of the Edystone Lighthouse. More foresight is needed both in the design and execution of works. The great value of a treatise like this is that it may be used to make a start in developing that prime quality of a civil engineer, "an infinite capacity for taking pains." The writer states in his preface:

> It may appear as if too much attention to details is given the examples on the design of joints, beams and trusses. It is believed, however, that the importance of careful study of every detail can only thus be properly emphasized. In practice, it seems to be the exception rather than the rule to give the same attention to details of timber structures as to those of steel. In the interest of sound engineering practice, it is essential that all connections and details have the same degree of security as the framed members.

The reviewer has designated this as a treatise on joints. For mechanical engineers the single word "bearings" speaks volumes, for that is a determining feature of efficiency and success in an infinite range of applications. So to the civil engineer the word, "joints," is equally significant. One of the chief advantages of monolithic construction with concrete is the removal at once of multitudes of joints, leaving only the problem of "expansion joints." Dams and breakwaters may thus be made immensely more secure and durable. Especially in all framed structures the study of joints to secure the best adaptation of the materials used, according to their suitable characteristics, and the adjustment of the parts to gain a maximum of simplicity, efficiency and durability, may well engage the best study and endeavor of the engineer. It is evident from what precedes that this manual will prove a valuable aid towards realizing that result. And, following out this idea, why not have another manual on joints in steel-work and one on joints

in masonry, including of course ample attention to the simplification of joints, having due regard to avoiding all unfavorable features and conditions.

The foregoing remarks on preservation of joints suggest the designation of a field of engineering too little recognized by title hitherto, to wit: engineering of conservation. Instead of entrusting the care of costly works to incompetent men, perhaps appointees of political bosses, they should be under custody or at least regular inspection of men with sufficient engineering education to enable them to recognize the evidences of deterioration and the structural features requiring especial attention to keep the works in proper condition. This field would include the duties of thorough inspection of structures by men familiar with the data and principles set forth in the treatise under review and others on the lines suggested.

Returning to some special topics in the book: the author properly calls attention to the undesirable characteristics of so-called flitched beams, and, per contra, to the good features of deepened beams for certain uses, because of the quickness with which they can be prepared and put in place, according to the practice of Mr. J. P. Snow, Chief Engineer of the Boston & Maine Ry. He also cites the interesting investigation of Prof. Ricker for obtaining a formula for the weight of wooden roof trusses of standard forms and differing spans. The defective features of some of the common details of construction are pointed out so as to indicate to the reader the directions in which greater simplicity and economy may be secured.

The material for the work has been selected with discrimination from a wide range of the best modern practice; the style of the author is direct and the subject matter clearly presented, with some originality where that is possible; and the treatise is a distinctly useful addition to the necessary library of a civil engineer.

CYRUS HALL McCORMICK.—His Life and Work. By Herbert N. Casson, Author of "The Romance of Steel," etc. Chicago, Ill.: A. C. McClurg & Co. Cloth; 5¼ × 8¼ ins.; pp. 264; 35 plates. $1.50, net.

We have here a very readable and not too lengthy account of the life of a man who, according to the author, invented the first practicable reaper and was responsible for its perfection and for its introduction throughout the world. Some will perhaps question whether Mr. McCormick is entitled to all the credit given to him by this enthusiastic author, although conceding that a large measure of credit is due to him. The book does make evident, however, that many master minds, both as inventors, manufacturers and salesmen (in the broader sense), contributed to the invention and use of the reaper. It seems rather far-fetched to couple Mr. McCormick's name, as the author does over and over, with those of many of his contemporaries and predecessors in literature and other fields; but this feature of the work adds interest and does no particular harm.

The book contains very little indeed in the way of information regarding the mechanical development of reaping machines. Possibly this is just as well for a book apparently designed almost exclusively for popular use; but we think even from this point of view the value of the book would have been increased, had there been a chapter or two on the mechanical development of the reaper, illustrated perhaps by a few drawings. Even the interesting half-tones presented, of which there are many, rarely afford an opportunity to study the McCormick reaper in detail, either at any particular stage of its evolution or as regards its evolution as a whole.

MACHINE SHOP DRAWINGS.—Reading Drawings, Making Shop Sketches, Laying Out Work. By Fred H. Colvin, M. Am. Soc. M. E., Associate Editor of "The American Machinist," Author of "Machine Shop Calculations," etc. New York: McGraw-Hill Book Co. Cloth; 4½ × 7 ins.; pp. 139; 91 illustrations in the text. $1, net.

The reading of working drawings is explained in this volume for the benefit of mechanics, or others, who have never had an opportunity to learn anything about drawings. Beginning with the simplest possible drawings, the reader is led along gradually to the more complicated examples. Attention is called to the legends and dimensioning as well as to the lines of the drawing. A chapter of general hints on methods of laying out is followed by two chapters on the laying out of spur and bevel gears. The final chapter gives brief elementary instruction in sketching.

Power, Heating and Ventilation.

Reviewed by WILLIAM H. BRYAN,* M. Am. Soc. M. E.

POWER HEATING AND VENTILATION.—A Treatise for Designing and Constructing Engineers, Architects and Students. By Charles L. Hubbard, Consulting Engineer, Boston. Part I.: Equipment. Part II.: Power and Lighting. Part III.: Heating and Ventilation. Brattleboro, Vt.: The Technical Press. Cloth; 5¾ × 9 ins.; pp. 647; 412 illustrations in the text. $5.

This is a formidable work, covering a wide field. In general, it is successful, and the profession is to be congratulated upon having placed at its disposal so large a mass of working data. The arrangement is clear and logical and the typographical execution creditable. The title is perhaps somewhat broad, as steam power is the only kind of power discused. In work of such magnitude, where the subjects covered are so diversified, it would be strange if there were not room for reasonable differences of opinion. It should be remembered, also, that some errors and inaccuracies are practically unavoidable in a first edition.

Taking up Part I., the author might have used—or at least referred to—the later and more reliable steam tables of Messrs. Marks and Davis,† rather than the Regnault data, which have for some time been known to be inaccurate. The statement as to superheated steam is not strictly accurate, as it is now known that there may be moisture in the presence of superheated steam. Steam in the center of a large pipe may be superheated while the outer layers are saturated, and there may even be some water in the bottom of a horizontal pipe.

The rating of tubular boilers, 15 sq. ft. per HP., is rarely used nowadays, except for boilers with very small tubes. The stated overload of 30% is also low. Modern boilers are designed for from one-third to one-half over load, and even greater margins are common. Rates of combustion are also rather low—particularly for low-grade Western coals, which can best be burned at about 25 lbs. per sq. ft. grate per hour.

The statement that the most satisfactory rate of combustion is about 0.3-lb. per sq. ft. heating surface per hour, irrespective of the type of boiler, is misleading. It results in the conclusion that tubular boilers require 50% more coal per HP.-hr. than water tube. Furthermore, it is not consistent with the later statement that the two types are practically equal in efficiency. The error comes from the original horsepower rating of 10 sq. ft. of heating surface for the water tube boiler, and 15 for the tubular. Even if such a difference existed in the work done per square foot, the coal burned would vary in exactly the reverse proportion. The statement that boilers of all the well-known types are of practically equal efficiency under the same conditions, is in the main true. It would be too much to say, however, that some types are not better suited for certain conditions of service, such as quality of fuel, the character of the load as to steadiness, dryness of steam, etc., than others. The low mechanical efficiency given for the ordinary steam pumps may also be criticised. Very small pumps, working under particularly unfavorable conditions, may fall as low as 50%, but the average of the larger sizes has been shown to be much greater, and under particularly favorable circumstances has reached 90%.

The methods for computing the boiler horsepower required for elevators are rather different from those used ordinarily by the reviewer, the power per car mile being the basing unit. The author's results check with reasonable closeness, however, except for the assumption that the car is in motion about 70% of the time. Extended observations of regular busy service indicate that one-third is nearer the average, with 50% as a maximum. The results are about double what the average plant would require. They also represent the maximum demand, which is, of course, proper in computing the boiler capacity necessary, but is misleading if the object is to ascertain the daily or average output in horsepower hours, the average service being much less than the maximum. For instance, when the building is being emptied very little actual power is required for electric elevators, as the loads pull the cars down, and the counterweights lift the empty cars.

It has been repeatedly demonstrated that the current required to drive electric elevators—assuming that the same total load is both raised and lowered—is simply the friction plus a small allowance for acceleration. The reviewer recently tested a plant consisting of three passenger elevators, speeded at 400 ft. per minute, and 3 freights, at 200 ft., which required an average of only 48 I. HP. in regular service. Modern cars in hard service may be operated at 3½-KW. hrs. per car mile—increased a little if many stops are made, and doubled for the short periods when cars ascend loaded and descend empty.

The data about the screw and duplex elevators might well have been omitted, as but few of these types are in use, and the number is not likely to be much increased. Data as to the performance of the more modern "traction" machines would have been interesting, their efficiency being somewhat better than the ordinary drum machines. Some exception might be taken as to the low efficiency given for engines (85%) and motors (80%), although the latter might apply on very small sizes.

There is no discussion of load curves, nor of overload capacity. The ratio between the number of lights and motors actually connected, to the maximum and average demands would have been valuable information—with the variations in different kinds of buildings. As the maximum load continues for but a short period of each day, and for only a few months of the year, it is better engineering to draw on the overload capacity of boilers, engines, and generators, rather than to install a plant large enough to carry the maximum load at rating, and thus tie up a large amount of unprofitable investment. There should, of course, be a reserve unit so that the service can be handled satisfactorily with the largest unit out of use. The reviewer's practice is to divide the plant into three units of approximately the same capacity, two of them to be capable of doing the maximum work at an overload of one-fourth to one-third. It is always wise to make some provision for growth also.

The data which follow as to forms and designs for standard boilers and furnaces call for no special comment, being along well established lines of good practice. Some particularly valuable data are furnished regarding design and details of pipe systems.

Part II.—The data on Power and Lighting are of equal clearness and interest with the others. The author does not make it entirely clear, however, why the product of pressure times volume is constant in a steam cylinder after cut off. While this is assumed to be true for saturated steam, it is not true for superheated steam nor for gases. It would have been better to have followed the long-accepted term "brake horsepower" (B. HP.), instead of "delivered horsepower" (D. HP.).

In discussing ratios of expansion the author should have pointed out that the earlier cut-offs named for compound and triple expansion engines do not refer to the high-pressure cylinder, but mean the equivalent cut-offs in the low-pressure cylinder. Eight per cent. is much too high a figure for the depreciation of a well-built modern engine. On the flat basis this would permit its amortization in 12½ years; and on the sinking fund basis, compounded annually at 3½% interest, in 10½ years. Fifteen to twenty years' life may fairly be assumed. The author's interest charge, 4%, is too low for average conditions.

In Fig. 31, the grease extractor should have been placed in front of the closed heater in

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*Consulting Mechanical and Electrical Engineer, 315 and 316 Lincoln Trust Building, St. Louis, Mo.

†[Reviewed in this Supplement for Aug. 12, 1909.—Ed.]

order to assist in keeping its heating surface clean. In referring to the starting of two-phase and three-phase motors the compensator used with the squirrel-cage type is stated to reduce the armature voltage at the start to about one-half that of the circuit. A more correct statement would be that it is the voltage at motor terminals which is reduced.

The glower of the Nernst lamp is not porcelain but of a rare alkaline earth, the exact composition of which is known only to the makers. It would hardly be proper to term the mercury vapor lamp an incandescent lamp. No mention is made of the Tungsten lamp, now coming into extensive use. The author states that the efficiency of the enclosed arc lamp is greater than that of the open lamp. The facts seem to be reversed, the efficiency of the open lamp—which is always operated in series—being much greater than the enclosed lamp, which is generally operated in multiple. There is but little difference when both are operated in series. Three-wire generators are largely displacing the use of two independent generators for three-wire distribution systems.

Part III., The Treatment of Heating and Ventilation, is particularly interesting. An excellent suggestion is that where two radiators are placed in one room, the capacity of one should be double that of the other, so that regulation may be had in the proportions of 1, 2 and 3. The statement of the relative costs of hot-air, steam, and hot-water heating should not be allowed to pass without comment. The increased cost of furnace heating is accompanied by a degree of ventilation which if obtained by steam or hot water would cost as much. Using recirculated air, as most steam or water systems must, furnaces burn no more fuel. Furthermore, the cost of steam heat can be brought down to that of hot water by using one of the modern systems of circulating steam below atmospheric pressure.

The air supply per occupant per hour is given at 2,400 cu. ft. for grammar schools; 1,800 is found ample in many large schools. It would seem, however, that the number of air changes per hour in public dining-rooms should be more than 4 to 5, and in public toilets more than 5 to 6. The use of the commonly adopted sinuous arrow to indicate vent openings would have been an improvement.

The author follows most writers in stating that heat losses are directly proportional to differences of temperature, while it is now well known that they increase faster. The heat losses in Table V. are per sq. ft. exposed surface, which important fact is not stated. The suggestion that where a room has a cold attic above it or a cellar beneath, 10% be added to its heat loss, is wholly empirical, but is perhaps justified by the lack of exact data on heat losses through floors and ceilings, and as to temperature conditions and heat losses in attics and cellars. This, however, is hardly consistent with his later statement that the heat loss through a wall adjoining an unwarmed apartment is two-thirds that of an outside wall. The author treats air leakage as a function (10 — 30%) of the computed heat loss due to exposure, and not an assumed number of changes of the entire volume per hour, as in the Carpenter and other well-known formulas. Both plans require the exercise of so large a factor of judgment as to leave much to be desired.

Possibly the author states the efficiency of house heating furnaces at too high a figure, 50 to 70%—averaging 60. The efficiency of steam ceiling coils of 200 to 250 B. T. U. per sq. ft. hour is low. Expansion loops are rarely used on risers now, the better plan being to anchor the riser midway of its length, taking the branches off in such a way as to permit movement of the riser.

The author appears somewhat confused as to the uses of the various forms of radiator valves. The angle valve is used where the branch comes up through the floor. The offset is suited for straight runs where it is desired to prevent trapping of water in the line. The corner valve is used where the connection is horizontal and where it must be thrown near the wall; also where the branch is made long enough to permit expansion and contraction of the riser. It is not made clear that the operation of air valves is due to changes of temperature and not of pressure, and that they remove not only the air in the radiators when they are cut in, but that which accumulates in regular service. In addition to the ordinary floor and ceiling plates used when pipe passes through floors, the 3-in. flange required by the Underwriters to prevent flow of water should have been mentioned. The special equalizing pipe connecting two heating boilers seems unnecessary where a main steam header ties them together.

The author does well to emphasize the necessity of installing vent flues in residences. These sometimes discharge directly into the open attic, and depend upon roof leakages to carry away the foul air. This plan is usually unsatisfactory and should be discouraged. In Table XXII. the velocities are feet per minute, not second, as stated; and in the "example" immediately preceding the heat emission is given per minute instead of hour.

The statement is made in one place that 65% of the exhaust from steam engines is available for heating, and in another 80%. The former assumes low feed temperature. As the returns usually come back at 200° F. or over, the higher percentage is nearer correct for average conditions. It is easy to readjust pressure and cut-off to maintain an engine's output with increased back pressure, but its steam efficiency always drops. Vacuum systems are not limited to old and poorly-designed systems. The lower pressure, the quicker circulation, increased radiator efficiency, and smaller mains are helps to even the best of heating systems.

In spite of the thoroughness, characteristic of the work, many branches of heating and ventilation are not referred to. Among these are central station systems, multi-vane fans, fan furnace heating, vacuum air and thermostatic valves, accelerated hot-water systems (such as the "Brückner"), sealed systems (such as the Honeywell and Klymax); the effect of lights and mechanical or chemical processes on ventilation; the effect of air washing on temperature and humidity; and comparisons between cast-iron and steel furnaces.

Such of our suggestions as appeal to the author may readily be added in later editions. Thus rounded out, the work may expect recognition as one of the most useful of recent years.

British Pioneers in Public-Health Work.

THE PUBLIC HEALTH AGITATION, 1833-48.—By B. L. Hutchins, Joint Author of "A History of Factory Legislation." London, England: A. C. Fifield. Cloth; 5 × 7¾ ins; pp. 150. 2 s. 6d., net; American price, $1.

More than half of this interesting little book is devoted to the life and work of Edwin Chadwick, pioneer in British sanitary investigation, agitation and reform. A chapter is given to Dr. Thomas Southwood Smith and another chapter to the "lesser pioneers," John Simon, Rumsey, Lord Shaftesbury, Charles Kingsley and Slaney.

The more strictly sanitary work of Chadwick was preceded by his labors on the Factory Commission of 1833, and on the Poor Law Commission of 1834. Both these lines were closely related to sanitation and revealed the need of the distinctive public-health work which was inaugurated with the Board of Health of 1848, of which Chadwick was one of the three members.

Southwood Smith, as he happens to have been more generally called, was closely associated with Chadwick or Chadwick's work throughout much of the active career of the latter, the two having served together on the Factory Commission already named. Smith approached the economic and sanitary problems of his day from the viewpoints of a physician and humanitarian familiar with the conditions and needs of the poor. Chadwick possessed or gained intimate knowledge of both economic and sanitary conditions, but he appears to have done this as a reformer and introducer of governmental administration rather than as a warm-hearted lover of his fellowmen.

Of the other "pioneers," bare mention only can be made of Sir John Simon, first Medical Officer of Health (1848) of the city of London, and of Charles Kingsley, "sometime Socialist, poet and novelist."

Mr. Hutchins' book promises to be particularly suggestive and helpful to many because all through it, and especially in his concluding chapter, he shows the close relationship between the economic and other environmental conditions of the mass of humanity and the health of the individual, the community and the nation. This relationship was recognized by most if not all of the sanitary pioneers, to the consternation of factory owners and landlords generally, who urged the "laissez faire" doctrine in opposition to the factory and sanitary inspection which resulted from the investigations and agitations of this band of reformers.

We quote, in conclusion, a few sentences bearing upon the broader relations of capital and industry to health and upon the importance of sanitary inspection:

The struggle between labor and capital is not an equal one, for capital does not have to pay its debts. Capital can use and wear out labor, and throw the burden on society. Capital takes the profits of labor, and if the conditions of labor are such as to result in phthisis, lead-poisoning, fever, premature death, widowhood, and orphanage, it is society that has to pay. Probably it is quite right that society should pay, but if so, it is certainly necessary that society should have a voice in determining the conditions, so as to limit the cost of life and energy to the lowest point that science can bring it to. The enormous subsidy that employers derive from the fact that they need not take the consequences of the industrial disease or accident to their employees, or at least need take them only to the extent of the very modest demands of the Factory Act or Workmen's Compensation, is an asset that does not appear in their balance sheets. It appears, however, on the other side of the Poor Law and charity accounts, sometimes also in crime and lunacy accounts, but is seldom recognized as such by deluded rate-payers.

It is of course quite true that the best employers do recognize their responsibility, take precautions for the health and safety of their employees, and make some provision for those who may become sick or disabled in their service. The fact remains, however, that human life is still very cheap, and human labor, unless of some specially rare skill, easily replaceable. In a great many industries it is cheaper to use up laborers than to go to the expense of making the conditions thoroughly safe and healthy. Cheaper, that is to say, to the individual employer, or company. The cost is shifted on to the community, who has to pay in all sorts of ways, direct and indirect. There is not only the direct cost of pauperism, disease, and crime, so far as these result from preventable causes; there is the far more subtle and incalculable element of deteriorated physique, deteriorated characters, diminished energy, that result from unhealthy conditions, and the diminished possibilities of the children brought up in these conditions by parents who have thus suffered. The conflict of interest between the community and the individual has been recognized by setting up the institution of the inspector. The inspector is there to see that the permanent interests of society do not suffer in the competitive struggle, or rather, that they do not suffer too flagrantly, for the inadequate, overworked staff of the present day are by no means capable of fully doing the work they have to do. The inspector is the symbol of the growth of a new conception of society. The old conception of a mere aggregate of warring atoms is felt to be inadequate. It does not satisfy, either morally or intellectually. The blind struggle of competition crushes out powers finer than it preserves, for the survivor, it is to be feared, tends to be the person who will take the lowest wages, or live in the dampest house, or accept the conditions least favorable to self-respect.

The inspector is a sign that society has begun to think. Children are no longer the mere property even of their parents, who have to comply with certain requirements of the state in regard to employment, education, and health. Even in regard to the new-born infant, naturally regarded as having the intensest, most individual and exclusive relation to its mother, learns that her baby is not a doll, or a plaything that concerns herself only, but that its future is a matter of concern to something outside the home. Even here comes in the third party to the bargain, a mysterious "not ourselves" embodied in the lady official whose ideas in regard to baby no doubt set tradition at defiance, as tradition is known in the slums, but who somehow manages to make it felt as a strong suggestion that the unseen "not ourselves" wants baby to live. Medical inspection of school children will carry on the same lesson in regard to older children. The Board of Education in a recent

circular states that the object of medical inspection is not merely to bring the child at school under the doctor, but to educate the parents themselves to a higher sense of responsibility for their children's health, and a higher standard of cleanliness and decency in the home.

How to Lay Brick.

Reviewed by OTTO A. HELRICH.*

BRICKLAYING SYSTEM.—By Frank B. Gilbreth, M. Am. Soc. M. E. New York and Chicago: The Myron C. Clark Publishing Co. London, England: E. & F. N. Spon, Ltd. Cloth; 6¼ x 9 ins.; pp. 321; 171 text illustrations. $3, net.

Here we have a treatise handling the subject of bricklaying in a direct and practical way so that it can be understood by any member of the craft, and which will teach all that is possible to learn of a practical nature regarding the best modern method in brick masonry.

It takes up the instruction and training of the apprentice and shows how to obtain the best results in the shortest time possible, both as to speed and accurate workmanship. Considerable space is given to the system of management, and especially to "athletic contests" and *how to derive the greatest profit from the men employed.*

The method of construction suggested is not based on any particular theory or technical feature. Instead, the aim is to show how to handle a job in the most economical manner and complete it in the shortest time. The author makes it clear that different methods must be applied to different jobs in order to make the best and fastest progress. Transportation of materials, erection and placing of runways; erection of observation towers from which directions may be given to the workers; placing of derricks and elevators in such a manner as to insure the greatest convenience as to stock; the erection of scaffolds, especially the so-called "Gilbreth" or patent scaffold, are treated with care and efficiency in the smallest details and in a plain and comprehensive way. Nearly all scaffolds in use have been dealt with, and that so as to show what advantage one has over the other; how to place mortar boxes and how to pile brick upon the staging; in short, all phases of the subject have been considered.

Two chapters are devoted to the "Gilbreth Packet System," a unique and economical way of handling brick, showing how time and labor can be saved by using this system. When using the "Packet System" together with the "Gilbreth scaffold" the bricklayer can do more and better work with no stooping and less exertion than he could by using any other method.

The building of tall chimneys and the getting of stock to the top of the chimneys as fast as the bricklayer can use it, has been successfully worked out and much valuable information is to be derived from this chapter.

The author shows how important good mortar is to masonry, and how a little lime will improve cement mortar for brickwork. He tells us that as a prevention from rust on steel columns nothing is better than Portland cement and sand, and also that any kind of mortar will cause deterioration of wood.

The quality of brick and how to ascertain absorption are explained in a thorough and able manner, as also how brick should be unloaded, culled and handled before use.

The tools used by masons are also described. In connection with this Mr. Gilbreth says:

> The day has arrived when bricklayers for their best interest must depart from the ancient custom of handling mortar from the mortar box to the wall with a trowel only.
>
> New devices must be adopted by this trade to cut down the cost of brickwork or bricklaying will become a lost art. . . . The time has come when bricklayers must awaken to the fact that the very existence of their craft is at stake. Means must be adopted to compete with this oldest [?] yet newest material of construction, concrete. . . . We do believe that the bricklayer must increase his output. He must remove all obstacles that make for reduced output. He must use every device that will lessen the cost of brickwork. The day has come when a bricklayer must adopt other tools than the trowel for handling his mortar. Not a shovel, not a bucket, nor a hod (for good brickwork cannot be done with mortar dumped into the wall) but a fountain trowel in which the ordinary bricklayer trowel is used as a temporary handle, can be used for spreading mortar better than mortar can be strung from a trowel. . . . This is but one of the new methods that must soon be adopted.

The use of the line, spirit plumb rule, plumb bob, and story-pole and the use of grade marks have been given special attention.

The author claims that the average bricklayer is making too many motions when laying brick and to demonstrate the truth of these assertions he has prepared "Motion Charts" comparing new and old methods of bricklaying.

Laying brick under special conditions; how to guard against encroaching on adjoining properties; bracing brickwork and laying brick in frosty weather; and how to lay fire-brick are taken up.

Jointing brickwork is explained in the best way the reviewer has yet seen. The method described is worthy of particular notice, which may also be said about the article on arches, trimmer arches and chimney breasts.

Under the heading of "Tearing Down, Cutting and Patching Brickwork," Mr. Gilbreth says:

> The best method of bricklaying is what is called the brick and brick method . . . where there is no special attempt to fill the vertical joints by shoving except on the outside face tier and the inside face tier. . . . We realize that this is revolutionary and against all old-fashioned doctrines; but it must be remembered that we are building under conditions that are distinctly different and that will upset many of the old traditions in brickwork. . . . We realize that many intelligent people will not understand and believe that the "brick and brick" or "brick-touching-on-their-vertical-joints" method is the best way to lay bricks in buildings, but every bricklayer knows this method and approves of it, provided good, soft mortar or grouting is used.
>
> Knowing the general prejudice in favor of shove joints we would not advocate the "brick and brick" method, if it were not for the fact that we cannot be suspected of any other motive than that of saving money for the owners for whom we work, as all of our work is and will be done on the basis of cost-plus-a-fixed-sum only and under this form of contract all savings go to the owner.

The use, durability, advantages and defects of terra cotta are set forth. The filling of put holes and working up against old walls is discussed. Other topics treated are toothing; racking and blocking walls; anchors; tie irons or bond irons, especially their use where blocking and toothing must be employed.

The last part of the book is not the least interesting. It takes up "Bond" and its meanings. There are about 60 pages of interesting reading and valuable information illustrated with 73 bond charts, showing nearly all kinds of bonds in existence.

The book contains 167 illustrations besides the above-mentioned bond charts.

*139 Buckman St., Everett, Mass.; Member of Bricklayers' Union No. 3, Boston, Mass.

Graphic Statics.

Reviewed by HENRY S. JACOBY,* Assoc. Am. Soc. C. E.

A TEXT BOOK ON GRAPHIC STATICS.—By Charles W. Malcolm, Assoc. M. Am. Soc. C. E., Assistant Professor of Structural Engineering, University of Illinois. New York and Chicago: The Myron C. Clark Publishing Co. London, England: E. & F. N. Spon, Ltd. Cloth; 6 x 9¼ ins.; pp. 316; 155 illustrations in the text. $3, net.

The relative prominence given to different parts of the subject is indicated by the following principal subdivisions of the volume: Part I. on elementary graphic statics contains 64 pages; Part II. on stresses in roof trusses, 102 pages; Part III. on beams, 42 pages; and Part IV. on stresses in bridge trusses, 102 pages.

The characteristic style of the illustrations will be readily recognized by all who are familiar with those drawn by the same author for Ketchum's Steel Mill Buildings. The attempt to use a modified form of Bows' notation in the part on elementary graphic statics leads to considerable repetition in letters and a loss of simplicity in some of the diagrams. The treatment of this part is somewhat more extensive than customary. It includes a number of special constructions, such as beams with loads of different inclinations, and in some problems several methods are given for the solution, as, for example, in finding the moment of inertia by Culmann's and by Mohr's methods, and for both approximate and accurate results.

In Part II. the stresses in simple roof trusses are given by algebraic moments, algebraic resolution, graphic moments and graphic resolution, the last method employing the stress diagrams in common use. The stresses in a three-hinged arch roof truss, in a transverse bent of a mill building with hinged and fixed columns, and in a grand-stand truss, are also determined, as well as the resultant shears in eccentric riveted connections. Considerable space is devoted to counterbraces in roof trusses.

In the notation for truss diagrams numerals are used in the spaces within the truss outline and capital letters for those without, the corresponding letters on the stress diagram being also capitals.

Part III. gives the bending moments and shears, and deflection diagrams for cantilever and simple beams under concentrated and distributed loads, and for beams fixed at one or both supports. Maximum shears and moments are determined analytically, as well as the positions of the moving loads which produce them. The deflection is also found for a plate girder, uniformly loaded and with a variable moment of inertia.

The bridge trusses in Part IV. include the Warren, Pratt, bowstring, Baltimore, Parker and Pennsylvania types, the last two types being, however, designated by other names. The loading treated includes dead, live and wind panel loads; and locomotive axle loads. In addition to the graphic analysis employed, the algebraic method of coefficients is given for dead and live panel loads. The criteria for the position of axle loads for maximum moments, shears and stresses are deduced with the aid of influence lines for the different types of trusses mentioned above.

Letters in the text referring to the notation of diagrams as well as those used for algebraic terms are printed in Roman instead of the Italic type usually employed for this purpose. In consequence pages containing formulas appear somewhat strange, while in other cases the legibility is diminished.

Throughout the volume the text gives evidence of constant care in preparation, and of close observation and study by a teacher who is thoroughly interested in his subject. The large number of diagrams employed prove that no labor was spared to secure adequate illustration. On the whole the text is more elaborate than in other similar works, a certain amount of repetition being apparently introduced for the purposes of emphasis and review. An index of six pages in small type completes the volume.

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ALTERNATING CURRENT MOTORS.—By A. S. McAllister, Ph. D. Third edition, revised and enlarged. New York: McGraw-Hill Book Co. Cloth; 6 x 9½ ins.; pp. 322; 138 illustrations in the text. $3, net.

The first edition of this work was very favorably reviewed by Prof. W. S. Franklin, in this Supplement for Jan. 17, 1907. At that time, it was characterized as simple and instructive throughout, good physics from beginning to end, and especially noteworthy in its treatment of induction motors.

In this later edition, has been placed a discussion of the essential features of the recent "split-pole converter and a chapter on synchronous motors." The section on "prevention of sparking in single-phase commutator motors" has been made to include machines with auxiliary commutating poles.

MODERN PRACTICE IN MINING.—Vol. II.: The Sinking of Shafts. By R. A. S. Redmayne, M. Inst. C. E., M. Inst. M. E., M. Inst. M and M., His Majesty's Chief Inspector of Mines. London, New York and Bombay: Longmans, Green & Co. Cloth; 5½ x 8¾ ins.; pp. 275; 172 illustrations, mostly in the text. $2.25, net.

About a year ago (Dec. 17, 1908, p. 690) we reviewed the first volume of this series by Prof. Redmayne, a series which the author proposed to make into a complete treatise on modern practice in mining. The first volume took up the general subject of coal mining; this second, noted above, is devoted entirely to the sinking of shafts. From the first volume it seemed that the set might make a very valuable contribution to the literature of mining and this impression is in no wise changed by the second of the series. While the general viewpoint is that of the British mining engineer and much of the terminology is strange to American ears, this is not so marked as to nullify the good of the book. For comparison of methods, if for nothing else, the American engineer can find in this second volume much that is useful.

The first chapter takes up the general layout of the shafts in a mine, that is, their position,

shape, size and number. The next four chapters are devoted to the mechanical processes of shaft-making, the tools and appliances, for digging, drilling, blasting and hoisting as well as the lining and timbering once the hole is dug. Chapter six is on the drainage, ventilation and lighting of the pits and chapter seven on costs. The last two chapters leave general methods and treat the difficult cases of sinking or the patented processes.

Excellent illustrations and printing add considerably to the appearance of the book.

A New Text-Book on the Steam Engine.

Reviewed by LIONEL S. MARKS,* M. Am. Soc. M. E.

THE STEAM ENGINE.—A Concise Treatise for Students and Engineers. By Charles H. Benjamin, Dean of the Schools of Engineering, Purdue University. Brattleboro, Vt.: The Technical Press. Cloth; 5¾ × 9¼ ins.; pp. 316; 198 illustrations in the text. $3.

In his preface Professor Benjamin describes his book as designed primarily for a text-book rather than as a work of reference for engineers. He says further that he has paid more attention "to practical problems and less to theoretical ones; more attention to the questions of the engineer and less to those of the scientist." This summing up of the book is an entirely just one and indicates its general characteristics. In the scope of subjects dealt with it resembles the English text-books, such as those of Holmes, Ewing and Ripper, rather than the usual American book; but it approaches the subject matter in a manner which is entirely different. It is such a book as past experience might lead us to expect from its author—clear, concise, practical, going straight to the point. If occasionally the treatment seems somewhat too brief or too simple, it is obviously because the author has set before himself the task of treating a big subject in a comparatively short space.

The earlier chapters deal with gases and vapors and the application to them of the laws of thermodynamics. It is to be regretted that the discredited 39° = F. B. T. U. is used; it never had any scientific or practical justification for its existence and it is to be hoped that it will soon disappear from text-books. The principal value of exact definition of the heat unit is in connection with precise physical measurement and for that either the 15° C. (approximately 60° F.) or the mean Calorie (or B. T. U.) are practically always used. In thermodynamic discussions it is of course the mechanical equivalent of the heat unit that is of importance and the value of the equivalent is not as precisely determined at 39° F. as at 60° F.

The definition of latent heat is open to serious objections. The author says there is a "latent heat of expansion," which he defines later as the difference between the specific heats at constant pressure and at constant volume. The latent heat of expansion of air he gives at 0.069 B. T. U. Surely this use of the term "latent heat" is entirely unjustifiable and is likely to lead to much confusion in the mind of the student. His own definition, namely, "Latent heat is heat which produces some other change in the substance than that of temperature," would not justify him in his use of a "latent heat of expansion," since external work cannot properly be called a change in the substance. The whole concept of latent heat as related to the phenomenon of change of state occurring while the temperature remains constant, is destroyed by this usage and nothing definite is substituted for it.

The opening chapter has a number of statements to which exception may be taken. As an example, the statement, "According to the law ($pv = kt$) the pressure of a gas *usually* diminishes as the volume increases, the temperature either remaining constant or gradually decreasing," is surely misleading since the pressure must *always* diminish under those conditions. Again, the statement that isothermal expansion may be obtained in a steam engine "by means of a steam jacket around the working cylinder" gives an entirely incorrect suggestion as to the purpose and action of the steam jacket. Another misleading statement is "that no engine working between the same limits of temperature and *entropy* can be more efficient" than an engine using the Carnot cycle; the inclusion of entropy is unnecessary and therefore misleading. The equation for the adiabatic expansion of saturated steam, it is stated, "is very nearly $pv =$ a constant;" this is very far indeed from being true. This is followed by a discussion of the Rankine cycle (with adiabatic expansion) and the work done in the cycle is given as

$$A = p_1 v_1 - p_2 v_2 + \frac{p_1 v_1 - p_2 v_2}{r - 1} = \frac{r}{r-1}(p_1 v_1 - p_2 v_2).$$

The only explanation of r is given in a table of abbreviations where it stands for ratio of expansion. The confusion manifest here arises probably from a series of printers' errors; as it stands it will puzzle the student considerably.

Occasionally the author's desire for brevity leads him into forms of statement which cannot be commended, as, for example: "The *percentage of entropy* in the heat diagram corresponds to the percentage of dry steam present;" by this sentence, he means, apparently, that the increase of entropy during vaporization is proportional to the amount of steam that is formed.

Notwithstanding the matters just referred to, the chapters dealing with the thermodynamics of heat engines are very directly and clearly written. Entropy is introduced at the outset, with the result that the deduction of the necessary formulas is much simplified. Whether this method of treatment is advisable or not is debatable, since the ease of development of the subject is offset by the increased difficulty, for the beginner, in grasping the fundamental concepts. The treatment is, moreover, so summary as to increase that natural difficulty, but it gains in interest by its broad and comprehensive scope. It is an interesting contribution to the methods of presenting this subject to the student.

The middle section of the book takes up the functions and theory of the various parts of the steam engine. Everywhere the treatment is comprehensive, precise and clear. There is no attempt to deal with constructive details, and this is one of the many virtues of the book. Most of the American works on this subject devote the greater part of their space to purely ephemeral and fundamentally unimportant details of construction and appear to consider it of prime importance that the student should be familiar with the peculiarities of construction which characterize a considerable number of engines by various makers. It is, of course, desirable that the student should be familiar with certain methods of construction which are generally regarded as standard, and these details are very satisfactorily treated of, in the present work, in a single chapter on Steam Engine Design, but it is very much more important that he should understand thoroughly the exact functions and the elementary theory of each part of the engine. A very just and satisfactory balance between these two requirements is maintained in this book. Chapters are devoted to valve and link motions, to indicators and indicator diagrams, to compound engines, to governors, to fly-wheels, to jacketing and superheating, to condensers and heaters, to piping and the flow of steam.

There are also chapters on steam-engine performance and on specifications and costs. The author has collected a very large body of data on engine cost and its variation with the size and type of the engine, and he presents the principal deductions from his data.

The book as a whole may be highly commended. It is not an easy book for the beginner; it is too highly concentrated for that. It is, however, clear and generally accurate and will doubtless be welcomed by many teachers as an excellent text-book with which to accompany their courses of lectures.

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TABLES AND OTHER DATA FOR ENGINEERS AND BUSINESS MEN.—Compiled by Chas. E. Ferris, Professor of Mechanical Engineering, University of Tennessee. 13th edition. Knoxville, Tenn.: University Press. Flexible leather. 2¾ × 5¾ ins.; pp. 246. 50 cts.

This handy little book is published by the University of Tennessee for the avowed purpose of bringing "before the minds of the men who control the affairs of the South, the strongest possible arguments in favor of technical education as a means of developing undeveloped resources." It appears in a new edition every little while, this one being the thirteenth. The contents include mathematical, interest, earthwork and hydraulic tables, properties of materials, and many advertisements of industrial machinery. The fifth edition of the book was briefly noted in our issue of July 13, 1905.

A Pruned Course in Electrical Testing.

DIRECT AND ALTERNATING CURRENT TESTING.—By Frederick Bedell, Ph. D., Professor of Applied Electricity in Cornell University, Assisted by Clarence A. Pierce, Ph. D. New York: D. Van Nostrand Co. Cloth; 5½ × 8¾ ins.; pp. 285; numerous illustrations in the text. $2, net.

One picks up another laboratory book on electrical testing with some little surprise knowing the number of fairly satisfactory texts (or sets of laboratory instructions and forms, rather) now published. Any one who has formulated a testing course for third and fourth year electrical-engineering classes, has recognized the need of very carefully selecting the minimum possible number of tests which can be made to show the principles involved and the preferable methods. Prof. Bedell has embodied his selections in this book.

The work is hardly to be considered in a class with such formidable and complete volumes as Prof. Karapetoff's "Experimental Electrical Engineering" or the older "Testing of Electro-Magnetic Machinery" by Swenson and Frankenfield. It nearer approaches, in scope, "Laboratory and Factory Tests," by Professors Sever and Townsend. There is much in this last-named work, however, which Prof. Bedell seems to have assumed should have been taught in the physics courses. Such topics as the use of instruments, methods of e. m. f., resistance and power measurement, effects of temperature rise, preparation of curve sheets, etc., for such reasons, have not been made prominent. Thus the program of the first experiment shows how to determine the characteristics of a series generator. In an appendix to this experiment such matters as current and voltage adjustment, temperature corrections and "fall of potential" method of measuring resistance are very briefly explained as minor matters. A similar procedure prevails throughout the book.

In most such courses experiments on a shunt-wound generator would follow this first experiment. Here, however, such a study is merged with that of a compound-wound machine. As the complete test of a compound generator duplicates the work on a shunt machine such consolidation seems advisable where time positively must be economized.

In direct-current motors the student is shown how to operate shunt and compound (also differentially compounded) machines, how to find the speed-current relations and the efficiency by the indirect method of finding the individual losses.

The series motor, efficiency of a generator, or a motor-generator and variations in the indirect test for efficiency are touched on in appendices to the direct-current motor experiments. This is all of the direct-current work given. The author's idea of its relative importance is shown by the portion of his book given to it—only a quarter.

The familiar work on the characteristics of alternators is abbreviated, much as was that on direct-current machinery and emphasis is placed on predetermining the performance of a machine without actually loading it.

The author states that "practically every problem in alternating currents can be reduced to a problem of series or parallel circuits," and he outlines work to show the general current-voltage relations of various arrangements, not as leading up to alternating-current testing but as the subject matter itself.

At first, Prof. Bedell takes up transformers along familiar lines, though with abbreviated studies. He takes up the application of the so called "circle diagrams," explains their theory and shows their application to transformer circuits. It will be remembered that, in a constant

potential alternating-current circuit of constant reactance and variable power consumption, if the values of current be plotted as vector quantities (the resultants of resistance and reactance components), the locus of the current vector will be the arc of a semi-circle. As Prof. Bedell first established this relation, and is most familiar with its many applications, naturally it occupies an important position in this book. The application is extended to induction motors by a few words of explanation. There is, in the course shown, no series of experiments on alternating current motors, and the book closes with a few selected studies of polyphase circuits and transformations, on the measurement of alternating-current power and on induction type voltage regulators.

The more an instructor studies this manual the more will he be impressed with the soundness of the general methods of economizing the student's time. But, as nearly every instructor likes to adapt experiments to suit his own peculiar ideas and the equipment with which he is forced to work, one cannot believe Prof. Bedell's selection of typical experiments will be completely concurred in. Some will contend probably that it is in no way thorough enough. But whether one follows it in whole or in part, or not at all, he will find it modern, suggestive and helpful.

The Mushroom System of Reinforced-Concrete Construction.

Reviewed by RUDOLPH P. MILLER,* M. Am. Soc. C. E.

CONCRETE STEEL CONSTRUCTION.—Part I.—Buildings. A Practical Treatise for the Constructor and Those Commercially Engaged in the Industry. By C. A. P. Turner, M. Am. Soc. C. E., Consulting Engineer, Bridges, Buildings and Manufacturing Plants, Concrete Steel Construction, etc. Minneapolis, Minn.: The Author (816 Phoenix Building). Cloth; 5¾ × 9¼ ins.; pp. 305; numerous illustrations in the text. $20.

"Any flag is good enough," said the Irishman, "just so it's green." Any type of construction will do for buildings, provided it is the "Mushroom System," is practically the author's text. The title page of the book leads one to expect a very complete and elaborate work on reinforced-concrete construction. Not only does the main title justify this expectation, but the price, boldly printed and made a part of the title page, is large enough to cover the cost of four or five of the larger standard works on the subject. This view is further strengthened by the subtitle, "Part I., Buildings," from which it would appear that later volumes will treat of bridges, stand-pipes and other structures that may be executed in reinforced concrete.

The expectation, in the opinion of the reviewer, is not realized upon examination of the work. The book contains much useful information and many valuable hints bearing on the "practical" side of reinforced-concrete construction; that is, on the execution and prosecution of the construction after satisfactory plans have been prepared. But considering the apparently large claim for the book and the importance of these branches of the subject, even from the author's standpoint, the treatment of the theoretical side is meager and the discussion of design is incomplete. Even the discussion of different types of building construction is practically limited to the "Mushroom System," an invention of the author protected by letters-patent, other types being mentioned only for purposes of comparison, and to be adjudged unworthy of further consideration.

It is not intended in this criticism to imply that a treatise on the particular subject of "Mushroom" construction would not be welcome. On the contrary, a complete, comprehensive and intelligible analysis of that construction by the inventor of the system would be a valuable contribution to engineering literature. It is in his failure to do this in the present work that the author has neglected a great opportunity. As it is, his book can be regarded as nothing more than a handbook advertising and advocating this particular type of construction. In fact, the author makes this clear in his preface, where, in his rather unconventional language, he states, among other objects of his book, that he "has been forced from *business exigencies* to conduct a kind of free school" and has found it desirable "to have some of the facts put in a book so that they might appear in the 'must be SO class,'" since "in his *business dealings* with building commissioners, inspectors, city architects, etc., he has found them good fellows all, but apparently hailing from the remote counties of Missouri in their extreme 'having to be shown' proclivities."

It becomes even incumbent on the author to do more than merely state his case, as he seems little disposed to accept the work and views of past and present investigators, condemning them generally "as of comparatively little value" (p. 49), being "of considerable value in a qualitative manner," but "nearly worthless from the quantitative standpoint" (p. 81); he berates an admittedly successful designer and competitor for "unfortunately" following "the lines of the ordinary treatises" (p. 143); and he charges the "highly scientific theories" followed by some poor innocent "Book taught Bilkins" with "indirect responsibility for such bad accidents as have occurred in concrete steel construction" (p. 276).

Reinforced-concrete construction for buildings is divided by the author into four types. Type I. consists of "columns supporting main girders" with "joists spanning from girder to girder and a thin floor covering the joists," as an example of which the author mentions the Bush Terminal Warehouse in Brooklyn, N. Y. Another example of this type is the Phelps Publishing Co.'s Building at Springfield, Mass. (Eng. News, Feb. 18, 1909). This is a very common form of reinforced-concrete building construction. Type II. differs from Type I. "by using girders in one direction and spanning from girder to girder with a slab supported on two sides by the girders." This type is represented by the Manufacturers' Furniture Exchange, Chicago, Ill. It is not an unusual form of construction, though perhaps not as common as Type I. Type III. the author regards as a "distinctive concrete type" having beams in two directions from column to column and slabs supported by them on four sides. The Northwest Knitting Company's Building, Minneapolis, Minn., is an example of this type of construction (Eng. News, June 8, 1905). It, too, is not an uncommon type. Type IV. is the form of construction known as the "Mushroom System," in which "the elements involved are two only, columns and continuous flat slabs supported by the columns." The author gives a large number of examples of this type, among which may be mentioned the Lindeke-Warner Building, St. Paul, Minn. (Eng. News, Feb. 18, 1909). This type of construction has found much favor in the west, and an example is found as far east as Philadelphia in the Grellet-Collins Building. In less than three pages these four types are described, discussed as to safety, economy, ease and accuracy of computation and fire-resisting qualities, and the conclusion drawn that "the four types in their order of merit rank in reverse order; IV. first, III. second, II. third, and I. fourth." Although, later on, occasional allegations are made to further support this conclusion, the text generally shows that its complete settlement is assumed.

It is difficult to judge whether the author would have his readers consider his work at all scientific, for he calls it "a *practical* treatise for the constructor and those commercially engaged in the industry," and yet in his articles on the computation of beams and slabs he speaks of "proceeding to the derivation of general formulas" and of "having derived a fairly accurate and scientific formula." All this supposed analysis occupies less than ten pages, including illustrations and more than a half page of notation. It is, in fact, not more than a statement of the three laws of mechanics governing the internal distribution of stress in beams, the formula of Major Sewell, as given in his paper before the American Society of Civil Engineers, and the three formulas expressing (1) the condition of equilibrium that the external and internal moments shall be equal, (2) the maximum bending moment for a uniformly distributed load, which he says "follows from the usual law of beams," and (3) the deflection in beams under a uniformly distributed load.

The acceptance of these well-established laws and formulas without further discussion would not cause comment but for the author's general attitude toward theoretical mechanics as applied to reinforced-concrete construction. For the types of construction which he condemns, notwithstanding that they represent the majority of existing concrete buildings, he seems to hold that the principles are not applicable. Yet he seeks to apply these principles to his particular type of construction. In view of this position he cannot well be excused for not elaborating in detail the application of these principles to his form of construction. His article on this topic does not even furnish sufficient material to serve as a basis for discussion. After stating where the maximum bending moment in the "Mushroom" slab might be expected, and pointing out that, although theoretically the bending moment at the center of his slab is zero and the compression in the concrete at that point is similarly zero, and that there is, nevertheless, some tension in the steel at the center of the slab due to the stress developed in the steel at the outer part of the central area where the moment is a maximum, he proceeds to the conclusion that for the determination of the working loads,

> we have only to test a panel of the finished construction until the first yielding of the steel and we can then by simple proportion determine an exact working load for a known tension in the metal.

He seems well satisfied with this conclusion, since he adds that

> our seemingly difficult problem has been solved in a simple and exact manner far more accurately than would be possible by attempting to determine Poisson's ratio of lateral extension under direct compression,

whatever that may have to do with it.

Continuing, the author states that

> for the Mushroom System in this manner [namely by actual test] we can readily determine that $M_s = \frac{W L}{50}$

[and] for deflections this formula becomes

$$\Delta = \frac{1}{7{,}000} \frac{W L^3}{\Sigma A_s d^3}.$$

It certainly would have added to the value of the book, if it is not really an essential part of it, had the author included at this point the data on which the coefficients in these two working formulas are based. The reader is simply asked to accept them.

From the next article it would appear that the more important of the two formulas, in the author's opinion, is that for deflection, and an effort is made to establish the accuracy of his formula by applying it to the cases on which the determination of the coefficient was apparently based. Even in these tests he does not seem entirely consistent, for he treats the partly distributed loads as though they were uniformly distributed, evidently overlooking the fact that the deflection from a concentrated load producing the same bending moment as a uniformly distributed load, does not cause the same deflection.

Time and space will hardly permit of a discussion of the topics of design and strength of

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columns, regarding which he also draws general conclusions without giving the full and complete data on which they are based.

The failure to treat fully the particular features of the "Mushroom System" is to be the more regretted when it is considered that many excellent structures of this type have been erected with eminently satisfactory results.

Two flagrant defects in the book should be mentioned. The book lacks an important essential of any scientific or technical treatise, namely, an index. Another fault, recently referred to by a writer in Engineering News as all too common in text-books and other technical works, is a want of clearness of expression, shown not merely in long, involved sentences, but also in loose and unintelligible language, as, for example, the third paragraph on page 25:

> Since the steel reinforcing bars can act only by strain along their length we see that in a general manner whether they are in single layers running in one direction or in double or multiple layers running in two or more directions that as far as the steel is concerned that their action must be similar in character to the flanges of a beam and hence since the strength of the plate, regardless of the distribution of the stresses in the concrete must depend on the tensile stresses in the steel, the general laws of bending would be of identically similar form to those for a beam.

FOWLER'S MECHANICS' & MACHINISTS' POCKET BOOK AND DIARY, 1910. A Synopsis of Practical Rules for Fitters, Turners, Millwrights, Erectors, Pattern Makers, Foundrymen, Draftsmen, Apprentices, Students, Etc., Etc. Edited by William H. Fowler, M. Inst. C. E., M. Inst. M. E., etc. Manchester, England: Scientific Publishing Co. Boards; 3¾ x 6 ins.; pp. 448; text illustrations. 6d., net; American price, 25 cts.

THE "MECHANICAL WORLD" POCKET DIARY AND YEAR BOOK FOR 1910.—Containing a Collection of Useful Engineering Notes, Rules, Tables and Data. Manchester, England: Emmott & Co., Ltd. Cloth; 3¾ x 6¼ ins.; pp. 391; text illustrations. 6d., net; American price, 25 cts.

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THE ENGINEERING OF ORDNANCE.—By A. Trevor Dawson, Lieut. R. N., M. Inst. C. E., M. Inst. M. E., etc. The Gustav Canet Lecture, delivered at the 25th Anniversary Meeting of the Establishment of the Junior Institution of Engineers, June 30, 1909. (Supplement to Vol. XIX. of the Transactions of the Junior Institution of Engineers.) London, England: Percival Marshall & Co. Paper; 7¼ x 9¼ ins.; pp. 53; 68 illustrations, partly in the text. 2s. 6d.; American price, $1.

At the death of Mr. Gustav Canet, of Havre, well known in Europe as an engineer and artillerist and president of the Junior Institution of Engineers, of England, this society, in connection with Mr. Canet's family, established a commemorative gold medal to be awarded annually to the reader of a paper before the society. Lieut. A. T. Dawson, Royal Navy, was invited to present the first lecture and, naturally, the subject was from the field of Mr. Canet's activity—ordnance.

The volume at hand is the Institution's reprint of the lecture. In it, Mr. Canet's work and influence in the development of ordnance is described, as one would expect. The lecturer proceeds then to a historical review of the development of heavy armament. In the reprint, all this matter appears introductory to the body of the paper.

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In our review of Mr. Fagan's first book, "The Confessions of a Railway Signalman" (Feb. 18, 1909; Lit. Sup., p. 19), we said that the author had in preparation a series of articles in which he would suggest some remedies for the conditions which have brought about the increased accident rate on the railways of the United States. The book noted in the head-piece is the one to which we referred, but our prediction as to its purpose was too early to be quite accurate. "Labor and the Railroads" does continue the investigation of the safety problem, but its field is more the causes than the remedies for the situation.

In his earlier book, Mr. Fagan sought to prove that most of the accidents on our railways were the result of the carelessness of the employees, and that for this carelessness the men and the management were equally responsible; the former because they cared nothing for the railroad and the public, but were all for their own personal advancement and comfort; the latter because it had lost its once strong disciplining control of the men. The second book sets up as a primary cause for this state of affairs, the enormous influence of the railway labor union upon the railway management, an influence that is manifested in the operating "schedule," the written agreement between the officials and the employees.

As long as this schedule confines itself to matters of pay, hours of work and limits of duty, the author thinks it is a perfectly proper contract to which the employees are entitled, but when it invades the field of authority, prescribes just how and when a man may be disciplined and just who shall be promoted, assumes, in fact, a dictation to the management as to its purely managerial duties, then the schedule is an unfair weapon in the hands of the labor unions and a breeder of contempt for authority which must react unfavorably upon the entire railway personnel. At present Mr. Fagan has no definite remedy, except to advocate a wider publicity of the evil, in the hope that the public, knowing the conditions, must surely bring about a reform and a cure.

LOCOMOTIVE BREAKDOWNS.—Emergencies and Their Remedies. By Geo. L. Fowler. Enlarged and Revised to Date by Wm. W. Wood, Air Brake Inspector. Sixth revised edition. New York: The Norman W. Henley Publishing Co. Flexible cloth; 4¼ × 6½ ins.; pp. 293; 98 illustrations, mostly in the text. $1.

This book is intended for the information of railway employees, and is of the catechism arrangement often used in books of this class. That it has been appreciated is indicated by the fact that six editions have been printed since it was reviewed first in our issue of Dec. 10, 1903. An important addition is a chapter on the Walschaerts valve gear and its emergency repairs, as this gear is now used very extensively in this country. Another chapter deals with accidents to compound locomotives. The various failures likely to occur in valve gear, cylinders, wheels, axles, frames, boilers and boiler fittings, draft appliances, air-brake apparatus, etc., are mentioned, and the methods of repair on the road are described.

REPORT ON THE WATERWAYS OF FRANCE, BELGIUM, GERMANY, AND HOLLAND.—By W. H. Lindley, M. Inst. C. E., Assistant Commissioner for the Foreign Inquiry. Vol. VI., Foreign Inquiry, Royal Commission on Canals and Waterways. Part I.: Reports and Appendices. Part II.: Maps and Tables. London, England: Wyman & Sons, Ltd. Paper; 8¼ × 13 ins.; pp. 223; folding maps and tables. 5s. 11d.; American price, $2.30.

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THE ORIGIN AND PREVALENCE OF TYPHOID FEVER IN THE DISTRICT OF COLUMBIA (1908).—By M. J. Rosenau, L. L. Lumsden and Joseph H. Kastle. Hygienic Laboratory, Bull. 52, Public Health and Marine-Hospital Service of the United States. Paper; 6 x 9 ins.; pp. 160; tables and folding plates. Washington: Pub. Doc., as above.

The results of the third year of study of typhoid fever in the national capital by a board appointed at the request of the Commissioners of the District of Columbia are here presented. (The studies of the earlier years were published as Bulls. 35 and 44.) The present bulletin summarizes information collected during personal visits to every case of typhoid fever reported to the district health department from May 1 to Nov. 1; an intensive study of 32 city blocks, containing 5,300 persons, following a suggestion by Prof. Wm. T. Sedgwick, and bacteriological examinations of the raw and filtered Potomac River water. The net result of the work of the third year was to strengthen the earlier conclusions to the effect that the water-supply could be held responsible for but a small part of the typhoid occurring in Washington, and that the bulk of the cases which could be traced to an origin were due to importation (disease contracted elsewhere), contact with previous cases and infected milk. Special studies made in Washington by Dr. L. O. Howard, Chief of the Division of Entomology, U. S. Department of Agriculture, showed little connection between the fly and typhoid. The report as a whole is a valuable document.

THE AMERICAN CITY.—Published Monthly by The American City Publishing Co., 98 Nassau St., New York City. 7 x 10 ins.; pp. 48; illustrated. $1 a year; 10 cts. a copy.

The first three numbers of this new semi-popular municipal journal (Sept., Oct., Nov.) contain an interesting variety of well-presented material on city planning, parks, playgrounds, public baths and gymnasia, municipal accounting, civic associations and the like. In addition, there are editorial notes on city affairs, departmental notes on village activities, gleanings from periodical literature and a few book reviews. The magazine presents an imposing list of some thirty-five well-known men and women composing an Advisory Board. It is edited by Mr. Arthur H. Grant, who, if we remember rightly, once edited an anti-municipal ownership journal called "Facts Concerning Municipal Ownership."

Publications Received.

ACCOUNTING EVERY BUSINESS MAN SHOULD KNOW.—By Elisha Ely Garrison. New York: Doubleday, Page & Co. Cloth; 4¾ x 7½ ins.; pp. 188. $1.20, net.

ANNUAL REPORT OF THE SOUTH AUSTRALIAN RAILWAY COMMISSIONER, 1908-1909.—Adelaide, South Australia: Pub. Doc. Paper; 8¼ x 13 ins.; pp. 64; map, traffic diagrams, and six half-tone engravings.

BEITRAEGE ZUR THEORIE UND BERECHNUNG DOPPELTGEKRUEMMTER FREITRAEGER UND VERWANDTER TRAGGEBILDE.—By Heinrich Seipp. Vienna, Austria, and Leipsig, Germany: A. Hartleben. Paper; 6¼ x 9½ ins.; pp. 48; nine illustrations in the text. 3 marks; American price, $1.20.

BULLETINS, U. S. GEOLOGICAL SURVEY.—George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 5¾ x 9¼ ins.

No. 390: Geology of the Lewistown Coal Field, Montana. By W. R. Calvert. Pp. 83; 5 plates (1 in pocket) and 1 text figure.

No. 404: The Granites of Vermont. By T. Nelson Dale. Pp. 138; 5 plates and 25 text figures.

No. 409: Bibliography of North American Geology for 1908. With Subject Index. By John M. Nickles. Pp. 148.

CHAUDIERES ET CONDENSEURS.—By F. Cordier. Encyclopédie Scientifique, Published under the direction of Dr. Toulouse. Bibliothèque de Mécanique Appliquée et Génie; M. d'Ocagne, Directeur. Paris, France: O. Doin et Fils. Cloth; 4¾ x 7¼ ins.; pp. 475; 154 illustrations in the text. 5 francs; American price, $1.50.

COMMISSIONER OF EDUCATION (U. S.).—Report for the Year Ended June 30, 1909. Vol. I. (Elmer Ellsworth Brown, Ph. D., LL. D., Commissioner.) Washington, D. C.: Pub. Doc. Cloth; 5¾ x 9¼ ins.; pp. 598.

COMMISSIONERS OF THE STATE RESERVATION AT NIAGARA.—Annual Report from Oct. 1, 1907, to Sept. 30, 1908. (Charles M. Dow, President, Jamestown, N. Y.) Albany, N. Y.: Pub. Doc. Paper; 5¾ x 9 ins.; pp. 52; 17 plates.

THE COST OF MINING.—An Exhibit of the Results of Important Mines throughout the World. By James Ralph Finlay, M. Am. Inst. M. E., Lecturer at Harvard University on the Economics of Mining. New York: McGraw-Hill Book Co. Cloth; 6 x 9¼ ins.; pp. 415; 22 illustrations in the text. $5, net.

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DIE EISENKONSTRUKTIONEN DER INGENIEURHOCHBAUTEN.—Ein Lehrbuch zum Gebrauche an Technischen Hochschulen und in der Praxis by Max Foerster, Professor of Structural Engineering at the Dresden Technical College. Fourth edition, improved and greatly enlarged. Leipsig, Germany: Wilhelm Engelmann. Paper; 7½ x 11 ins.; pp. 1040; 1413 illustrations in the text; 37 folding plates in separate volume. 50 marks; American price, $20. Bound in cloth, 56 marks; American price, $22.40.

THE ELEMENTS OF MACHINE DESIGN.—Part I.: General Principles; Strength of Materials; Rivets, Bolts and Other Fastenings; Journals and Shafting; Couplings; Pedestals; Transmission of Power by Gearing, Belting, Ropes and Chains. By W. Cawthorne Unwin, LL. D., F.R.S., M. Inst. C. E., Hon. M. Inst. M. E., Hon. M. Am. Soc. M. E., etc., Emeritus Professor of Engineering, Central Technical College, Kensington. New edition, revised and enlarged. London, New York and Bombay: Longmans, Green & Co. Cloth; 5½ x 9 ins.; pp. 531; 387 illustrations in the text. $2.50.

ENERGY.—Work, Heat and Transformations. By Sidney A. Reeve. New York: McGraw-Hill Book Co. Cloth; 6 x 9 ins.; pp. 238; 14 illustrations in the text. $2, net.

HISTORY OF CHEMISTRY.—By Sir Edward Thorpe, Author of "Essays in Historical Chemistry," etc. Two volumes. I.: From the Earliest Times to the Middle of the 19th Century. New York and London: G. P. Putnam's Sons. Cloth; 4¼ x 6½ ins.; pp. 195; illustrated. 75 cts.

HYDRAULIC TABLES AND DIAGRAMS FOR PRACTICAL ENGINEERS.—By Capt. A. ff. Garrett, Executive Engineer Indian Public Works Department, Author of "Hydraulic Diagrams for the Design of Channels in Earth by Kutter's Formula," etc. London, New York and Bombay: Longmans, Green & Co. Cloth; 14¾ x 9¼ ins.; pp. 47; text illustrations, 24 plates and 54 tables. $5.

ILLINOIS BUREAU OF LABOR STATISTICS.—Annual Coal Report, 1908. David Ross, Secy., Springfield. Springfield, Ill.: Pub. Doc. Cloth; 5⅞ x 8¾ ins.; pp. 443.

INDUSTRIAL PEACE AND INDUSTRIAL EFFICIENCY.—Sir Christopher Furness's Co-Partnership Scheme. An Account of "The Treaty of the Hartlepools." New York: American Anti-Boycott Association (27 William St.). Paper; 5¼ x 8 ins.; pp. 30.

INSPECTOR'S HANDBOOK OF REINFORCED CONCRETE.—By Walter F. Ballinger, Assoc. Am. Inst. of Architects, M. Am. Soc. C. E., and Emile G. Perrott, Assoc. Am. Inst. of Architects, Assoc. M. Am. Soc. C. E. New York: The Engineering News Publishing Co. London, England: Archibald Constable & Co., Ltd. Flexible leather; 4¾ x 7 ins.; pp. 66; six folding plates. $1.

LIGHT.—By Richard C. Maclaurin, LL.D., Sc.D., President of the Massachusetts Institute of Technology. New York: The Columbia University Press. Cloth; 5¼ x 8 ins.; pp. 251; 1 plate and 70 text illustrations. $1.50, net.

LUMBER, LATH AND SHINGLES, 1908.—Forest Products, No. 2. Compiled in Cooperation with the Department of Agriculture: Forest Service, Gifford Pinchot, Forester. Bureau of the Census; E. Dana Durand, Director. Washington, D. C.: Pub. Doc. Paper; 6 x 9¼ ins.; pp. 87.

MUNICIPAL TAXATION.—An Address before the League of American Municipalities, Montreal, 1909. By A. C. Pleydell. Canadian Systems of Local Taxation: Extracts from Addresses by W. Robb, Treasurer, Montreal; F. S. Spence, Controller, Toronto; Theo. A. Hunt, City Solicitor, Winnipeg; John Perrie, Provincial Tax Commissioner, Alberta; J. B. McKilligan, Surveyor of Taxes, British Columbia. New York: New York Tax Reform Association (56 Pine St.). Paper; 5⅜ x 8½ ins.; pp. 20. 10 cts. each; 6 cts. each in lots of ten or more.

OUR NATIONAL PARKS.—By John Muir. New and enlarged edition. Boston and New York: Houghton Mifflin Co. Cloth; 5⅜ x 8½ ins.; pp. 382; 33 plates. $1.75, net.

PHYSICAL FEATURES OF THE DES PLAINES VALLEY.—By James Walter Goldthwait. Bulletin No. 11, Illinois State Geological Survey. Urbana, Ill.: University of Illinois. Cloth; 5⅜ x 9¼ ins.; pp. 103; 9 plates and 21 text illustrations.

PRACTICAL TESTING OF ELECTRICAL MACHINES.—By Leonard Oulton, Assoc. M. Inst. E. E., and Norman J. Wilson, M. Inst. E. E., Assoc. Am. Inst. E. E. London and New York: Whittaker & Co. Leatherette; 4 x 6½ ins.; pp. 210; 90 illustrations in the text. $1.40, net.

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PRIMER OF SANITATION.—Being a Simple Work on Disease Germs and How to Fight Them. By John W. Ritchie, Professor of Biology, College of William and Mary, Virginia. Yonkers-on-Hudson, N. Y.: World Book Co. Cloth; 5¼ x 7⅛ ins.; pp. 200; 111 illustrations in the text. 60 cts.; by mail, 80 cts.

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SOME PLANS AND SUGGESTIONS FOR HOUSING CONSUMPTIVES.—New York: The National Association for the Study and Prevention of Tuberculosis (105 East 22d St.; Dr. Livingston Farrand, Executive Secretary). Paper; 6¾ x 10¼ ins.; pp. 87; 95 text illustrations and 1 plate.

STRESSES IN MASONRY.—By Herbert Chatley, Professor of Civil Engineering, Tong Shan Engineering College, N. China, Author of "How to Design in Steel," etc. London, England: Charles Griffin & Co. Philadelphia, Pa.: J. B. Lippincott Co. Cloth; 4¾ x 7½ ins.; pp. 146; 22 illustrations in the text. $1.25, net.

THE THEORY OF STRUCTURES.—By R. J. Woods, M. Inst. C. E., Author of "The Strength and Elasticity of Structural Members." London, England: Edward Arnold. Cloth; 5⅛ x 8¼ ins.; pp. 276; 157 illustrations in the text. $3.

TIDE TABLES FOR THE EASTERN COASTS OF CANADA.—For the Year 1910. Including the River and Gulf of St. Lawrence, the Atlantic Coast, the Bay of Fundy, Northumberland and Cabot Straits; and Information on Currents. Issued by the Tidal and Current Survey in the Department of Marine and Fisheries of the Dominion of Canada; W. Bell Dawson, M. Inst. C. E., Superintendent. Ottawa, Can.: Pub. Doc. Paper; 6½ x 9½ ins.; pp. 55.

TOWN PLANNING IN PRACTICE.—An Introduction to the Art of Designing Cities and Suburbs. By Raymond Unwin. London, England, and Leipsic, Germany: T. Fisher Unwin. Cloth; 7¼ x 10 ins.; pp. 416; 298 illustrations, partly in the text, and 6 folding maps. 21s., net; American price, $8.40.

TRAIN DISPATCHERS' ASSOCIATION OF AMERICA.—Annual Convention, Columbus, O., June 15-17, 1909. (J. F. Mackie, Secy., Chicago, Ill.) Paper; 5¼ x 7¾ ins.; pp. 219; plates.

WATER-SUPPLY PAPERS, U. S. GEOLOGICAL SURVEY.—George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 6 x 9 ins.

No. 227: Geology and Underground Waters of South Dakota. By N. H. Darton. Pp. 156; 15 plates (2 in pocket) and 7 text figures.

No. 233: Water Resources of the Blue Grass Region, Kentucky. By George Charlton Matson. With a Chapter on the Quality of the Waters, by Chase Palmer. Pp. 223; 3 plates and 6 text figures.

ZAHLENBEISPIELE ZUR STATISCHEN BERECHNUNG VON BRUECKEN UND DAECHERN.—(Appendix to the second edition.) Entwicklung und Erläuterung der Benutzten Gleichungen. Prepared by G. Barkhausen and Robert Otzen, Professors at the Technical College in Hannover. Wiesbaden, Germany: C. W. Kreidel. Paper; 7 x 11 ins.; pp. 119; 83 illustrations in the text. 3.6 marks; American price, $1.50.

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